

Owner Manual



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Battery Charger 15Amp(12Volt), 12Amp(24Volt)

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Specifications

BATTERY CHARGER FEATURES								
Compatible Battery Types			12 or 24-Volt Lead-Acid, Gel, AGM, Ni-Cad					
Maximum Charge Rate			15 Amps @ 12 VDC or 12 Amps @ 24 VDC					
Operating Input	Voltage				120,	208, 240, 277	, 380, 416, 4	80, 600 VAC
Operating Input	Frequency					50	or 60 Hz	
Charge Control					4-5	Stage Automati Chargir	ic Charger wit	th Equalize s
Available Batter	y Type Settings				Lead-Acid / Gel / AGM / Ni-Cad			
Configurations					Star	nd-Alone and T	ransfer Swite	h Assembly
Temperature Se	ensing:							
Charger Terr	nperature				lı	nternal Charge	r Temperatur	e Sensor
Temperature	Compensation C	Charging			C	Optional Batter	y Temperatur	e Sensor
Network Interfac	ce (Not currently a	available)				RS-48	35 Connector	
Alarm Contacts						2 Am	ps, 30 VDC	
			ENVIRONI	MENT				
Temperature Ra Specifications	inge When Opera	ating Within UL	BBHH		-22 to +122 Degrees F (-30 to +50 Degrees C)			F C)
Operating Temperature Range				-22 to +140 Degrees F (-30 to +60 Degrees C)				
Non-Operating Temperature Range				-22 to +	158 Degrees	F		
				(–30 to ⊣	-70 Degrees	C)		
Relative Humidity				95%	(Drip-Proof)			
WEIGHT AND DIMENSIONS								
Weight					11.6 lbs (5.22 kg)			
Dimensions: Lei	ngth x Depth x He	eight			9.75 x 5.56 x 6.14 Inches (247.6 x 141.2 x 156 MM)			
		ELE	CTRICAL	RATIN	GS			
INF	TUY	12V B/	ATTERY CHA	RGER		24V B/	ATTERY CHA	RGER
VOLTAGE (NOMINAL)	CURRENT (AMPS)	OUTPUT VOLTAGE	FLOAT VOLTAGE	OUTE CURR (AME	PUT ENT PS)	OUTPUT VOLTAGE	FLOAT VOLTAGE	OUTPUT CURRENT (AMPS)
120, 208, 240	4.7, 2.75, 2.4	15.0	13.5	15.	0	30.0	27.0	12.0
277	2.1	15.0	13.5	15.	0	30.0	27.0	12.0
380	1.5	15.0	13.5	15.0		30.0	27.0	12.0
416	1.4	15.0	13.5	15.	0	30.0	27.0	12.0
480	1.2	15.0	13.5	15.	0	30.0	27.0	12.0
600	1.0	15.0	13.5	15.	0	30.0	27.0	12.0

UL LISTING

The battery charger is UL listed for BBHH and BBGQ type applications (battery chargers for emergency standby generators). In BBHH and BBGQ applications,

- The battery charger can only be used with leadacid batteries. Other battery types can be used in non-BBHH/BBGQ applications.
- The battery charger is rated at 50°C ambient.
- The maximum amp-hour capacity rating for this charger is 200 amp-hours for BBHH and BBGQ applications. This is based on the maximum size battery bank the charger can completely charge from a 0% state of charge in a 24 hour time frame. For Non–BBHH or BBGQ applications the amp–hour capacity rating should be kept under 400 amp–hours.



FIGURE A. BATTERY CHARGERS WITH UL MARKINGS

Electricity and batteries present hazards which can result in severe personal injury or death.

Thoroughly read this manual before operating the battery charger. Safe operation and top performance can only be attained when equipment is operated and maintained properly.

The following symbols in this manual alert you to hazards to operators, service personnel, and equipment.

A DANGER This symbol alerts you to an immediate hazard which will result in severe personal injury or death.

AWARNING This symbol alerts you to a hazard or unsafe practice that can result in severe personal injury or death.

ACAUTION This symbol alerts you to a hazard or unsafe practice that can result in personal injury or equipment damage.

ELECTRICITY

All electrical connections must be made by trained and experienced electricians in accordance with applicable codes.

Use caution when working on live electrical equipment. Remove jewelry, use tools with insulated handles, make sure clothing and shoes are dry, and stand on a dry wooden platform or insulating pad.

Disconnect all sources of AC and DC power from the battery charger before servicing.

BATTERY CHARGER

Do not use the battery charger unless the battery voltage matches the output voltage rating of the charger.

Do not operate the battery charger in a closed-in area or restrict ventilation in any way.

Never place the battery charger directly above or below the battery. Gases or fluids from the battery can corrode and damage the charger.

Do not expose the battery charger to rain, snow, or other precipitation.

Do not operate the battery charger if it has received a sharp blow, been dropped, or otherwise been damaged in any way. If damaged, take it to a qualified service technician.

Grounding Instructions: This battery charger should be connected to a grounded, metal, permanent wiring system; or an equipment-grounding conductor should be run with circuit conductors and connected to an equipment-grounding terminal or lead on the battery charger. Connections to the battery charger must comply with all local codes and ordinances.

Use of an attachment not recommended or sold by the battery charger manufacturer can result in a risk of fire, electric shock, or personal injury.

BATTERIES

To reduce the risk of injury, only use this battery charger to charge rechargeable batteries of the types listed in this manual. Other types of batteries can burst, causing personal injury and property damage.

Carefully read and follow all of the battery manufacturer's instructions and safety precautions, such as removing or not removing cell caps while charging. Recommended rates of charge and allowable operatoring/charging ambient temperature range. Batteries should be provided appropriate ventilation when being charged.

Never charge a frozen battery.

Do not smoke when servicing batteries. Wear safety glasses. If acid gets in your eyes or on your skin, flush with water for 15 minutes and get medical attention.

To keep sparks from igniting explosive battery gases, always disconnect AC power to the battery

charger and turn off all DC loads before disconnecting the battery cables.

The high capacitance of the battery charger can cause sparking whenever battery cables are disconnected or reconnected. This is normal, do not be alarmed. Take the following precautions:

- 1. Do not disconnect or reconnect the battery charger when fuel fumes are present.
- 2. To keep sparking away from the batteries when disconnecting battery cables:
 - a. Disconnect the negative (–) cable from the battery charger and then the Batteries.
 - b. Disconnect the positive (+) cable from the battery charger and then the Batteries.

3. To keep sparking away from the batteries when reconnecting battery cables:

- a. Reconnect the positive (+) cable at the Batteries and then at the battery charger.
- b. Reconnect the negative (-) cable at the Batteries and then at the battery charger.

Introduction

This manual provides information on the installation and operation of the 4-stage, 15 and 12 amp, battery chargers with equalize charging capabilities. These battery chargers can charge 12 volt or 24 volt lead-acid, Ni-Cad, AGM, or Gel batteries.

NOTE: Starting with version 1.22, this battery charger supports adjustable float voltages and Ni-Cad batteries. For versions prior to 1.22, do not use your battery charger to charge Ni-Cad batteries! To determine version, see BATTERY CHARGER CON-FIGURATION section.

This battery charger is intended for use in permanently wired, industrial applications. This battery charger is designed for use as a stand-alone charger.

MODEL IDENTIFICATION

To identify your model, refer to the certification label located on the top of the battery charger (see Figure 1). Electrical characteristics are shown on the nameplate.

If there is a problem with the operation of the battery charger, contact your local distributor and give the complete description. This information is necessary to properly identify your unit among the various types manufactured.

HOW TO OBTAIN SERVICE

If your battery charger requires servicing, contact your nearest Cummins Power Generation dealer or distributor. Factory-trained Parts and Service representatives are ready to handle all of your service needs.

Information to have available when calling:

- Part Number including Spec Letter, Serial Number, and Date Manufactured (gray boxes in Figure 1)
- Nature of problem (see Troubleshooting, on page 19).
- NOTE: When using any PCCNet device on a genset control application, the wiring used to connect ALL devices in the net-

work must be Belden 9729 Two Pair, Stranded, Shielded Twisted Pair Cable (24 AWG).

AWARNING Improper service can result in severe personal injury or death and damage to equipment. Service must be performed by trained and experienced personnel.



FIGURE 1. CERTIFICATION LABEL

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Description and Operation

DESCRIPTION

The control panel is located on the top of the battery charger.

A 20 amp DC circuit breaker switch, AC wiring, and three connectors are included on the front of the bat-

tery charger (see Figure 2). 120, 208, and 240 VAC battery chargers include two 10 amp AC circuit breaker switches. All other models include two AC fuse holders on the front of the battery charger.

The battery charger contains an internal temperature sensor and cooling fan.



FIGURE 2. TYPICAL BATTERY CHARGER

BATTERY CHARGER CONTROL PANEL

The battery charger control panel includes a digital display, a RESET button, and an LED status indicator (see Figure 3).

Digital Display

The battery charger includes a 2-line x 16-character digital display that displays menus and faults.

Reset Button

The RESET button is used to select menu options and to clear fault messages.

LED Status Indicator

The control panel includes a status LED that displays the appropriate color for the following conditions.

- Green On solid indicates unit is charging
- Amber On solid indicates Equalizing
- **Red** On solid indicates a fault condition. See the digital display for the fault number.



FIGURE 3. CONTROL PANEL

Setup Menus

The Configuration Mode includes setup menus that can be used to set the battery voltage and type. Refer to page 17 for more information. All battery charging is disabled when Configuration Mode is entered.

Faults

The following is a list of the eight possible faults that can be displayed on the control panel digital display.

- Overcurrent (fault code 379)
- High battery voltage (fault code 442)
- Low battery voltage (fault code 441)
- Input undervoltage (fault code 2331)
- Input overvoltage (fault code 2358)
- Charger overtemp (fault code 2544)
- Unrecoverable battery (fault code 9115)
- Battery overtemp (fault code 2263) only available on installations that include the optional battery temperature sensor

Each fault displayed includes a description and a fault code number (an example is shown in Figure 4). Battery charging will cease when any of these faults occur. More information on battery charger faults is included in the *Troubleshooting* section, starting on page 19.



FIGURE 4. HIGH BATTERY VOLTAGE FAULT

CIRCUIT BREAKERS AND FUSES

All units include a 20 amp DC output circuit breaker. Battery chargers also include either two 10 amp AC input circuit breakers or two fuses. As indicated on the label on the lower front panel, circuit breakers are enabled when in the up position (see Figure 5). This label also includes circuit breaker wiring information.

DC Output Circuit Breaker

The 20 amp DC circuit breaker provides output circuit overcurrent protection. If the circuit breaker trips (is in the OFF (down) position), there will be no DC output. Correct the possible overload and reset the circuit breaker.

AC Input Circuit Breakers / Fuses

The 10 amp AC circuit breakers (120, 208, and 240 VAC battery chargers) or fuses (277, 380, 416, 480 and 600 VAC battery chargers) provides input circuit overcurrent protection. They protect the AC power input leads connected to the battery charger. If an AC circuit breaker is tripped (is in the OFF (down) position) or a fuse is blown, there will be no DC output. The required fuses for models that use them are listed in Table 1.

To power down the unit and then power it back up, trip one of the AC input breakers.

If either circuit breaker trips, the circuit has shorted. If a circuit breaker trips, reset the circuit breaker. If a fuse is blown, it must be replaced.



FIGURE 5. CIRCUIT BREAKER INFORMATION

TABLE 1. REQUIRED FUSES

Charger Input Voltage	Fuse
277 VAC	5 Amp
380 or 416 VAC	3.5 Amp
480 or 600 VAC	2.5 Amp

TEMPERATURE SENSORS

Internal Temperature Sensor

An internal temperature sensor monitors the temperature of the charger and displays a warning message (fault code 2544) if the temperature is too high.

Battery Temperature Sensor

Most battery manufacturers recommend that batteries not be used in conditions higher than 120 degrees F (48.6 degrees C) for Nicad, and 104 degrees F (40 degrees C) for Lead–Acid (wet LA, Gel, AGM). Batteries exposed to high temperatures can result in shorted battery cells or an improperly vented battery chamber. Valve Regulated Lead Acid batteries are particulary prone to gassing due to high temperatures.

The connector for the battery temperature sensor is located on the front of the battery charger (see Figure 6). The battery temperature sensor is connected from the battery charger to the positive terminal of the battery. A fault message (fault code 2263) is displayed if the battery temperature is too high (reaches 131 degrees F (55 degrees C)).

If the temp sender becomes open/disconnected, the charger temperature defaults to 100 $^\circ\text{F}.$

ALARM OUTPUT

The battery charger includes a fault output relay that is activated (contacts close) when faults occur. The contacts are rated at 2 amps/30 VDC. This feature can be used by wiring a fault indicator to the fault alarm output connector located on the front of the battery charger (see Figure 2).

COOLING FAN

The cooling fan is located inside the battery charger (see Figure 2). The fan turns on when the internal battery charger temperatures reaches 158 degrees F (70 degrees C). The fan turns off once the internal battery charger temperatures drops to 140 degrees F (60 degrees C).



FIGURE 6. OPTIONAL BATTERY TEMPERATURE SENSOR

Battery Charging and Maintenance

BATTERY CHARGING

The battery charger normally goes through the following four stages when charging a battery.

- 1 Low / Dead Battery Charging Only required if the battery is deeply discharged
- 2 High (Bulk) Charging
- 3 Medium (Absorption) Charging
- 4 Low (Float) Charging

Stage 1 — Low / Dead Battery Charging

If the battery is deeply discharged, this stage is required to determine if the battery can be charged or needs to be replaced.

A battery is considered to be deeply discharged when its voltage is less than 10.2 VDC (12V batteries) or 20.4 VDC (24V batteries). If the charger determines that the battery is not deeply discharged, the charger immediately transitions to bulk charging mode.

When a battery is deeply discharged, the battery charger transitions to a trickle current mode and limits the DC output current to 0.5 amps until a DC voltage of 10.2 (or 20.4) VDC is reached. At that time, the battery charger transitions from Stage 1 charging to bulk charging mode (Stage 2) and continues charging at full output.

If the battery voltage does not rise to 10.2 (or 20.4) VDC within ten hours, the battery is considered to be dead and the warning message "BATT FAIL" (fault code 9115) is displayed. Replace the battery.

Stage 2 — High (Bulk) Charging

The charger enters bulk charging mode when external AC power is applied and the battery voltage is greater than 10.2 volts for 12 volt batteries or 20.4 volts for 24 volt batteries. Otherwise, the charger enters a low battery charging mode (see "Stage 4 – Low (Float) Charging").

The battery charger maintains constant charging current during high (bulk) charging. During Stage 2

charging, current is limited by the maximum charging current, maximum charger current draw, and/or AC circuit breaker rating.

The battery charger maintains Stage 2 charging until the bulk voltage is reached.

Stage 3 — Medium (Absorption) Charging

The battery charger switches to Stage 3 charging when the high charge (bulk) voltage is reached. When in the absorption stage, the unit outputs constant voltage. The current is only limited by the charger's output capability or the maximum charger output set point. If the optional battery temperature sensor is used, the regulated voltage is compensated, based on the battery temperature.

The absorption current level depends upon battery type and bank size (see Table 2).

The battery charger maintains the high charge voltage until one of the following conditions are met.

- The maximum absorption time has elapsed (3 hours).
- The charging current is over 14.2 amps. It then reverts back to bulk charging mode.
- Charging current is at or less than the absorption current threshold (4 amps).

After the absorption state is complete or the maximum absorption time has elapsed, the charger switches to float charging mode.

Stage 4 — Low (Float) Charging

The battery charger switches to Stage 4 charging after the absorption stage is completed or the absorption time expires. The battery charger remains in Stage 4 charging until charging is disabled, external AC power is removed, or output exceeds 90% of the bulk mode. If output exceeds 90% of the bulk mode, the charger reverts back to bulk charging mode. If the optional battery temperature sensor is used, the float voltage is compensated, based on the battery temperature.

Parameter	Wet Cell	Gel (Standard)	AGM	Ni-Cad ⁵
Bulk Volts – 12V Battery (VDC) ¹	14.2	14.0	14.4	15.5
Bulk Volts – 24V Battery (VDC) ¹	28.4	28.0	28.8	29.0
Float Volts – 12V Battery (VDC) ¹	13.5 ⁴	13.5 ⁴	13.5 ⁴	13.5 ⁴
Float Volts – 24V Battery (VDC) ¹	27.0 ⁴	27.0 ⁴	27.0 ⁴	27.0 ⁴
Equalize Volts - 12V Battery	15.5	N/A	N/A	N/A
Equalize Volts - 24V Battery	31.0	N/A	N/A	N/A
Maximum Absorption Time (Hours)	3	3	3	3
Absorption Amps ²	4	4	4	4
Temperature Compensation Offset (VDC) ³	0.03	0.03	0.03	0.03

TABLE 2. DEFAULT BATTERY CHARGING PARAMETERS AT 25°C⁶

1. The default Bulk and Float voltages shown are at the default battery temperature of 80° F (27° C). Battery chargers that have a battery temperature sensor connected will automatically recalculate charge voltage based on battery temperature. See the diagram below.

2. Absorption Amps is the current level at which the charging algorithm transitions to Float (Low) Charging. See the diagram.

3. The Temperature Compensation Offset is the voltage offset per cell per 10° F (5.6° C) increment in battery temperature greater or less than 77° F. The voltage offset is added to charging voltage for temperatures below 77° F and subtracted for temperatures above. Using the default value in the table, the voltage offset for 12 VDC is plus or minus 0.18 volts per 10° F (0.03 x 6 cells = 0.18). (A 12-volt battery consists of 6, 2-volt cells in series.)

4. Float voltage is configurable. The value indicated is the default.

5. Ni-Cad batteries are only supported in software version 1.22 or greater.

6. If the temp sender is open or disconnected, the default temperature is 100°F, and all voltage levels are reduced by the appropriate compensation of .03 volts per cell per 10°F.



BATTERY MAINTENANCE

Carefully read and follow all of the battery manufacturer's recommendations for maintenance and storage and observe all safety precautions.

In addition, the following guidelines for wet-cell batteries will help to ensure long battery life.

- Shallow battery discharges lead to longer battery life. Discharges of 50 percent or less are preferable. It is recommended that batteries be recharged after each period of use.
- Discharging more than 80 percent of a battery's total capacity can reduce its life. Leaving a battery discharged more than 50 percent for extended periods of time can damage the battery plates and reduce its life. For maximum battery life, do not discharge more than 40 percent of a battery's capacity.
- Batteries that can be charged but cannot support a load are probably failing and should be replaced.
- Periodic equalize charging is recommended to remove sulfate crystals that can build up on the lead plates. The failure to eliminate sulfation can result in reduced battery capacity and life. Many battery experts recommend that batteries be equalized periodically, ranging anywhere from once a month to once or twice per year, depending on usage. Consult the literature provided by the battery manufacturer for recommendations.
- The electrolyte level in Wet Cell batteries should the checked at least once a month. Always keep the level just above the top of the plates in each battery cell by adding as much distilled water as necessary. Allowing the electrolyte level to fall below the top of the plates will lead to shorter battery life. Using tap water will lead to shorter battery life due to its high conductivity (500 to 5000 times that of distilled water).

ACAUTION Allowing the electrolyte level to fall below the top of the plates in a Wet Cell battery will lead to shorter battery life.

- Equalize charging is an important maintenance procedure for Wet Cell batteries, *though not all Wet Cell batteries require equalization (see* EQUALIZE CHARGING on page 10).
- For models with fuse holders, always replace the fuses with UL and Canadian Standards As-

sociation (CSA) certified fuses of the specified amp rating (see page 23).

CONNECTING / DISCONNECTING BATTERIES

Always First Disconnect AC Power and DC Loads

To keep sparks from igniting explosive battery gases, always disconnect AC power to the battery charger and turn off all DC loads before disconnecting the battery cables.

AWARNING Battery acid can cause severe burns. Always wear safety glasses and protective clothing when working with batteries. If acid gets in your eyes or on your skin, flush with water for 15 minutes and get medical attention.

AWARNING Remove hanging jewelry, rings and bracelets before working on batteries. They can short and weld to battery terminals causing severe burns.

AWARNING Lead-Acid Batteries produce explosive hydrogen gas that can lead to severe personal injury—Do not smoke near batteries—To reduce sparking, always disconnect AC power to the battery charger, turn off all DC loads before disconnecting the battery cables and observer the Proper Battery Terminal Connection / Disconnection Sequence below.

Always Observe Proper Battery Terminal Connection / Disconnection Sequence

The high capacitance of the battery charger can cause sparking whenever the battery cables are disconnected or reconnected. This is normal, do not be alarmed. Take the following precautions:

1. Do not disconnect or reconnect the battery charger when fuel fumes are present.

2. To keep sparking away from the batteries when disconnecting battery cables:

- a. Disconnect the negative (-) cable from the battery charger and then the batteries,
- b Disconnect the positive (+) cable from the battery charger and then the batteries.

3. To keep sparking away from the batteries when reconnecting battery cables:

a. Reconnect the positive (+) cable at the Batteries and then at the battery charger,

b. Reconnect the negative (-) cable at the batteries and then at the battery charger.

Always Observe Proper Battery Polarity

Always observe battery polarity when making battery connections to the battery charger. Positive (+) must always be connected to Positive (+) and Negative (-) to Negative (-).

A CAUTION Damage as a result of reverse polarity is not covered under Warranty.

BATTERY TYPE CONFIGURATION

The installer must configure the battery charger for the type of batteries installed, unless Lead-Acid, which is the default. This can be done at the digital display of the battery charger control panel (see page 17).

EQUALIZE CHARGING

Equalize charging is an important maintenance procedure for wet cell batteries, *though not all wet cell batteries require equalization.*

Reasons for Equalize Charging

- Batteries produce electricity as the electrolyte (sulfuric acid and water) chemically reacts with the lead plates to form lead sulfate. Charging with electricity reverses the process: the lead plates are restored and the sulfate ion is returned to the electrolyte. Normal charging does not, however, completely restore the lead plates. After many cycles lead sulfate can accumulate on the plates reducing the effective plate area, thus robbing battery capacity. Over time the lead sulfate will crystallize, further increasing battery resistance. Equalize charging removes most of the accumulation of lead sulfate by controlled over-charging at a higher charging voltage for a specific length of time.
- Because sulfuric acid is denser than water (higher specific gravity), stratification of water and acid takes place over time. The bubbling action involved in equalize charging remixes the water and acid to restore the uniform specif-

ic gravity throughout the battery cell necessary for optimum battery performance.

- Equalize charging is also useful for determining whether a battery should be replaced. The higher the specific gravity, the higher the State of Charge (SOC). If specific gravity after equalization is still less than that specified by the battery manufacturer:
 - The battery might be old, approaching the end of its life
 - The battery might have been left discharged for too long
 - Electrolyte might have been lost or spilled
 - A bad cell might be developing
 - Too much water might have been added to the electrolyte.

Safety Precautions for Equalize Charging

- Equalizing will evaporate water from the battery cells. Add just enough distilled water before and after equalizing to cover the tops of the plates.
- Open up the battery compartment as much as possible for better cooling and ventilation.
- Disconnect all DC appliances before equalizing to prevent damage from the high equalize charging voltage.

ACAUTION Disconnect all DC appliances before equalizing to prevent damage from the high equalize charging voltage. Liability for damage to appliances left connected is the sole responsibility of the person performing equalize charging.

• Batteries must be attended while equalize charging. Be prepared to stop charging if a battery cell overflows, splits, or cracks.

ACAUTION Equalize charging can destroy batteries for which it is not a suitable maintenance procedure. Read the battery manufacturer's instructions to make sure equalize charging is a suitable maintenance procedure.

Equalization

Battery experts recommend that Wet Cell batteries be equalized periodically. This should be done anywhere from once a month to twice a year, depending on usage. Follow the recommendations of your battery's manufacturer.

NOTE: Equalize charging is to used only when the battery charger is configured for Wet Cell (Lead-Acid) batteries. To skip over the Equalize Battery menu, press and hold the **RESET** button until normal operation commences.

It can take up to 6 hours to equalize charge. Batteries must be attended while equalizing. Someone familiar with the process and safety procedures should be present to stop charging if a battery overheats or a cell overflows, splits, or cracks.

AWARNING Lead-Acid Batteries produce explosive hydrogen gas that can lead to severe personal injury. Do not smoke near batteries. Wear safety glasses. Keep sparks and other sources of ignition away. Make sure you understand all of the safety precautions described above before equalize charging your batteries.

ACAUTION Disconnect all DC appliances before equalizing to prevent damage from the high equalize charging voltage. Liability for damage to appliances left connected is the sole responsibility of the person performing equalize charging.

Equalize charge cannot be started until the battery is fully charged. The battery should be in float mode before you enter the configuration mode and try to start equalize charging.

Use the **RESET** button to initiate Equalize Charging after the battery charger is configured for wet cell batteries. For more information on using the configuration mode of the battery charger to equalize charge, see "Battery Charger Configuration" on page 17.

REPLACING BATTERIES

AWARNING Do not use batteries of other types than specified for use with this battery charger. Other types of batteries can explode, causing severe personal injury.

 The battery charger is designed for use only with batteries of the Wet Cell (lead-acid), Gel Cell (GEL), Absorbed Glass Mat (AGM), or Nickel-Cadmium (Ni-Cad) types. Other types of batteries can explode when subjected to the charging duty cycle of this application. (Engine starting batteries are not suitable for deepcycle service. They have thin plates designed for brief, high-current service. They tend to warp and become unserviceable as a result of the heat generated in deep-cycle service.)

AWARNING Do not use batteries of other types than specified for use with this battery charger. They can explode causing severe personal injury.

- Do not mix different types of batteries (Wet Cell, GEL, AGM, Ni-Cad). Each type of battery has a different set of optimum charging parameters. Performance will not be optimum if there is a mix of battery types. Some will be overcharged, others undercharged. Overcharging a battery reduces its life.
- For units that include the DC output circuit breaker and the two AC input circuit breakers, trip all three circuit breakers to remove power before replacing a battery.
- For units that include the DC output circuit breaker and the two fuses, remove the AC power source before replacing a battery.
- Before connecting the charger, check the battery voltage and make sure that the battery charger is configured for the correct battery voltage (see page 18).
- Before connecting the charger, make sure that the battery charger is configured for the type of batteries installed (see page 18). When replacing batteries with a different type, it will be necessary to reconfigure the battery charge for the new type of batteries.
- Make sure to reconnect the batteries properly.
- Used batteries must be disposed of in accordance with local environmental regulations.

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Installation

AWARNING Improper installation can result in severe personal injury, death, or damage to equipment. The installer must be trained and experienced in the installation of electrical and mechanical equipment.

This battery charger can be installed for use with a generator.

This battery charger should be connected to a grounded, metal, permanent wiring system; or an equipment-grounding conductor should be run with circuit conductors and connected to an equipment-grounding terminal or lead on the battery charger.

Connections to the battery charger must comply with all local codes and ordinances. Guidelines for connecting and disconnecting batteries are listed on page 9.

All DC connections must be performed by or supervised by a trained and experienced electrician in accordance with the NEC (National Electric Code, NFPA No. 70).

GENERATOR INSTALLATIONS

Location

Select a mounting location that is large enough to install the battery charger (see Figure 7).

<u>AWARNING</u> The charger can cause sparks that can result in severe personal injury and equipment damage. Do not mount the charger near batteries, fuel tanks, or other sources of flammable or explosive gases.

CAUTION Gases or fluids from the battery can corrode and damage the charger. Never place the battery charger directly above or below the battery.

The mounting location for the battery charger must:

- Be water proof.
- Be on a vibration-free mounting surface that will support the weight of the charger
- Not be hot, moist, or dusty. The battery charger is suitable for operation in a temperature range of -22 to +122 Degrees F (-30 to +50 Degrees C).

- Be isolated from batteries and fuel tanks and other sources of flammable or explosive gases. The charger (which can cause sparks) should be located as far away from the battery as practical.
- Allow for free air flow through the space or compartment. The battery charger has an internal cooling fan. Make sure there is no blockage of the air vents. Air flow is from right to left through the battery charger. Provide at least 2 inches (50.8 mm) of clearance to the right and left sides for good cooling air flow.
- Allow for adequate space for all electrical connections.
- Allow for easy access to remove the charger for service or replacement.
- Allow for easy access to the digital display and the circuit breaker(s).

The battery charger should be mounted on a wall or on a horizontal surface, such as a bench.

Wall Mounting

The top of the charger is drip-proof when it is wall mounted. For wall mounting, do not place the charger above the battery; gases from the battery can corrode and damage the charger.

- 1. Make sure that the AC power source is disconnected.
- 2. Check the location to be sure that no wires, plumbing, gas lines, or exhaust lines running behind the wall.
- 3. Position the charger on the wall.
- 4. Mark the location for the top two mounting holes.
- 5. Remove the charger and drill the mounting holes.
- 6. Use two 1/4" bolts to mount the charger on the wall.
- 7. Mark the location for the bottom two mounting holes.
- 8. Drill the mounting holes.
- 9. Use two 1/4" bolts to secure the charger to the wall.
- 10. Tighten the bolts.



FIGURE 7. BATTERY CHARGER DIMENSIONS

Bench Mounting

For bench mounting, do not place the charger above or below the battery; gases or fluids from the battery can corrode and damage the charger.

- 1. Make sure that the AC power source is disconnected.
- 2. Position the charger on the mounting surface.
- 3. Mark the location for the four mounting holes.
- 4. Remove the charger and drill the mounting holes.
- 5. Reposition the charger on the mounting surface.
- 6. Install four 1/4" diameter mounting bolts.
- 7. Tighten the bolts.

Charger Wiring

AWARNING AC voltages present an electrical shock hazard that can cause severe personal injury or death. Make sure that the AC power source is disconnected before proceeding.

- 1. Make sure that the AC power source is disconnected.
- 2. Remove the ground (-) cable of any battery that will be connected to the charger.

AWARNING Ignition of explosive battery gases can cause severe personal injury and equipment damage. Do not smoke or cause any spark, arc, or flame while servicing batteries.

- 3. Remove the three screws, and the access cover (bottom panel) from the front of the battery charger.
- 4. Remove one or both of the knockouts from the front of the battery charger (see Figure 8).
- 5. Install grommet(s) in the opening(s).

If necessary, remove the top panel to install the grommet(s), as described below (see Figure 9). Removing the top panel may also be beneficial for installing the wiring (see steps 6 and 7).

- a. Remove the nut(s) securing the circuit breaker switch(es) to the panel.
- b. Remove the screw securing the top panel to the battery charger. Then remove the top panel.
- c. Install the grommet(s).
- d. Use the screw to reinstall the top panel.
- e. Reinstall the nut(s) on the circuit breaker switch(es).
- 6. Use 16 AWG or larger wire for AC connections of up to 100 feet. Feed the wires through an opening. Connect AC input wires to AC1 and AC2 of TB1 (see Figure 8).



FIGURE 8. WIRING CONNECTIONS (ACCESS COVER REMOVED)



FIGURE 9. REMOVING BATTERY CHARGER PANELS

7. Install DC wiring to the battery charger.

ACAUTION Undersized cables can result in additional charger stress, lower efficiency, and diminished charger performance. Always use the recommended cable sizes. All cables must be UL and CSA certified.

- a. Select the appropriate DC battery cable(s) for the distance between the battery charger and the batteries. If your installation must meet the NFPA110 requirement to return a fully discharged battery to 100% of its ampere-hour rating within 24 hours, see Table 3. If your installation does not need to meet the NFPA110 requirement, see Table 4.
 - **NOTE:** Only 12 AWG or smaller cable can be installed on the battery charger terminal block. Therefore, any dis-

tances greater than 10 feet require that 10 feet of 12 AWG wiring first be installed on the terminal block and then the appropriate larger cable be attached for the remaining distance.

- b. Feed the wires selected through an opening.
- c. Connect the positive wire to B+ and the negative battery lead to B- of TB2.
- 8. If the battery charger is more than 10 feet from the battery, connect additional wiring to the cable installed in step 7.
- 9. Remove the hex nut and one of the EIT lock washer from the ground lug inside the battery charger. Feed a ground lead (16 AWG or larger) through an opening and use the hardware to secure the lead to the ground lug (see Figure 8).

TABLE 3. RECOMMENDED DC BATTERYCABLE SIZE FOR INSTALLATIONS WITHNFPA110 BATTERY CHARGE REQUIREMENT

Distance	Gauge
1 to 3 Feet (.3048 to .9144 Meters)	14
3 to 5 Feet (.9144 to 1.524 Meters)	14
5 to 10 Feet (1.524 to 3.048 Meters)	12
10 to 15 Feet (3.048 to 4.532 Meters)	12 and 10
15 to 25 Feet (4.532 to 7.62 Meters)	12 and 8
25 to 40 Feet (7.62 to 12.192 Meters)	12 and 6
40 to 60 Feet (12.192 to 18.288 Meters)	12 and 4
60 to 100 Feet (18.288 to 30.48 Meters)	12 and 2

TABLE 4. RECOMMENDED DC BATTERY CABLE SIZE FOR INSTALLATIONS WITHOUT NFPA110 BATTERY CHARGE REQUIREMENT

Distance	Gauge
1 to 20 Feet (.3048 to 6.096 Meters)	14
20 to 30 Feet (6.096 to 9.14 Meters)	12
30 to 50 Feet (9.14 to 15.24 Meters)	12 and 10
50 to 80 Feet (15.24 to 24.38 Meters)	12 and 8
80 to 125 Feet (24.38 to 38.1 Meters)	12 and 6

10. Reinstall the access cover (bottom panel).

AWARNING Ignition of explosive gases can cause severe personal injury and equipment damage. Do not smoke or cause any spark, arc, or flame while servicing batteries.

AWARNING AC voltages present an electrical shock hazard that can cause severe personal injury or death. Take special care to avoid contact with a hot AC line.

- 11. Connect AC power to the battery charger.
- 12. Configure the battery charger as described on page 17.

AWARNING Batteries can cause severe personal injury due to sparks, explosion and acid. Always connect or disconnect a battery in accordance with CONNECTING / DIS-CONNECTING BATTERIES (see page 9).

13. Connect the DC output wires to the battery (negative [-] lead last). Use the torque specified in Table 5 for the terminal type used for cable connections.

TABLE 5. RECOMMENDED TORQUE VALUES

Terminal Type	Max Torque Value
SAE, Tapered Terminal Posts	50–70 in-lbs
Slide Terminals	70–90 in-lbs
Threaded Stud Terminals	120–180 in-lbs

Generator Installations With Chargers Used in Parallel

For parallel use, battery chargers should be hooked up as if each one is the only charger. A minimum of six inches of space between chargers is necessary for adequate air flow. Attach the cables for each charger at the battery terminals only. Do not hook them in series or at each others terminal blocks. Each charger needs its own set of wires running to the battery and attached at the battery. The wire lengths from each charger should be the same length. Power up all chargers at the same time.

BATTERY CHARGER CONFIGURATION

The charger identification screen is displayed on the control panel for less than one second upon power-up (see Figure 10).

NOTE: The charger identification screen shown in Figure 10 is for version 1.22. For older chargers, the version is not displayed. If the version is not displayed, do not use your charger to charge Ni-Cad batteries!



FIGURE 10. CONTROL PANEL IDENTIFICATION SCREEN

The battery charger must be configured for the correct battery voltage and type before it is connected to the battery. To configure the battery charger, press and hold the **RESET** button for two seconds to enter the Configuration Mode. Adjust the Setup menus, as necessary.

 The first charger Setup menu displayed is for setting the battery voltage. Press the **RESET** button to change the battery voltage (12 or 24 VDC, default = 12 VDC) – see Figure 11.



FIGURE 11. BATTERY VOLTAGE SETUP MENU

- 2. Press and hold the **RESET** button for two seconds to save the setting and display the second Setup menu (Battery Type).
- 3. When the Battery Type Setup menu is displayed (see Figure 12), press the **RESET** button to select the battery type (Lead-Acid, Gel, Ni-Cad [version 1.22 or greater], or AGM, default = Lead-Acid).

SET BATT TYPE: Lead-Acid

FIGURE 12. BATTERY TYPE SETUP MENU

- 4. Press and hold the **RESET** button for two seconds to save the setting and display the third Setup menu (Float Voltage).
 - **NOTE:** The Float Voltage menu is only available in software versions 1.22 or greater.



FIGURE 13. FLOAT VOLTAGE SETUP MENU

5. When the Float Voltage setup menu is displayed, press the **RESET** button to select available float voltages (see Table 6). Consult your battery datasheet for the best possible choice.

TABLE 6. FLOAT VOLTAGES

12 VDC	24 VDC
12.8	25.7
13.0	26.1
13.3	26.6
13.5	27.0
13.6	27.2
14.3	28.6

- 6. Press and hold the **RESET** button for two seconds to save the setting.
- 7. If the battery type selected is lead-acid and it is completely charged, the Equalize Battery screen is displayed (see Figure 14).



FIGURE 14. EQUALIZE BATTERY SCREEN

- 8. Press the **RESET** button and release it immediately to begin equalize. The LED status indicator turns amber.
 - **NOTE:** To skip over the Equalize Battery! menu, press and hold the **RESET** button until normal operation commences. Equalize can be stopped by pressing the **RESET** button for two seconds (reentering Setup) or by powering down the battery charger.

ALARM OUTPUT WIRING

A two-position terminal block is included for wiring the alarm output relay to a customer-provided external fault indicator (LED, alarm, etc.).

BATTERY TEMPERATURE SENSOR INSTALLATION

If the optional battery temperature sensor is to be included in your installation, refer to the Instruction Sheet included with the temperature sensor kit.

Troubleshooting and Service

FAULT INDICATIONS

Most troubleshooting issues result in fault codes that are displayed on the battery charger's digital display. Overload conditions or equipment failures may require additional troubleshooting. Troubleshooting procedures are listed in Table 7.

- **NOTE:** Any fault code stops the charger from charging the battery.
- **NOTE:** There are no serviceable parts inside the charger assembly.
- **NOTE:** Fill out a failure incident report for any troubleshooting.

Troubleshooting at the Battery Charger Digital Display

When a fault occurs, the red fault LED lights and a brief description of the fault and the numeric fault code is displayed on the digital display (see Figure 4). To correct the fault, find the fault code number in Table 7 and take the suggested corrective actions. Call an authorized distributor for help if the problem persists.

Clearing Displayed Faults

Most displayed faults are cleared by the fault code being removed. However, faults 379 – OVER CURR, 442 – HIGH BATT VOLT, and 9115 – BATT FAIL can only be cleared by cycling completely through the Setup menus or by powering down the charger.

TABLE 7. TROUBLESHOOTING

<u>A WARNING</u> Some battery charger service procedures present hazards that can result in severe personal injury or death. Only trained and experienced personnel may perform service.

WARNING Ignition of explosive battery gasses can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.

Fault	Description	Possible Cause	Solution
379 – OVER CURR	Output Overload	Output current is excessive. The charger control may be failing.	Cycle through the Setup menus to try and clear the fault. If the fault returns, the charger control may have failed. Replace the charger.
441 – LOW	Low Battery	1. No battery connected.	Verify that the battery is connected.
BATT VOLT Voltage		2. Output breaker is in the "Off" (down) position.	Verify that the output breaker is in "On" (up) position.
		3. The charger is set for 24V charging with a 12V bat- tery connected.	Attach a 24V battery or set the charger for 12V charging.
		4. The battery can no longer maintain a charge.	Replace the battery.
		5. The wire between the charger and the battery is loose or broken.	Check the wire. Verify connections. Verify wire resistance is less than 1 Ohm.
		6. The battery is undersized.	Replace the battery with a properly sized battery.
		7. The battery cables are un- dersized.	Verify the cable gauge using Tables 3 and 4.

TABLE 7. TROUBLESHOOTING (CONT.)

WARNING Some battery charger service procedures present hazards that can result in severe personal injury or death. Only trained and experienced personnel may perform service.

A WARNING Ignition of explosive battery gasses can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.

Fault	Description	Possible Cause	Solution		
442 – HIGH BATT VOLT	High Battery Voltage	1. The charger is set for 12V charging with a 24V bat- tery connected.	Attach a 12V battery or set the charger for 24V charging.		
		2. A large load dump may have caused momentary voltage rise.	Verify that large loads are switching in and out and are causing voltage changes.		
2331 – LOW AC VOLT	Low Input Voltage	AC input voltage is more than 10% below nominal rated voltage.	Check the level of the input voltage. The charger will not operate with voltage 10% or more below nominal.		
2358 – HIGH AC VOLT	High Input Voltage	AC input voltage is more than 10% above nominal rated voltage. Check the level of the input The charger will not opera voltage 10% or more above nominal.			
2263 – HIGH BATT TEMP (For installations that include the	Battery Temperature is above 55 degrees C	1. The battery's ambient tem- perature is too high.	Move the battery into a cooler location. The charger will automatically begin charging again after the battery temperature lowers.		
temperature sensor)		 The battery sensor has failed. 	Replace the battery sensor.		
		3. Possible shorted cells within the battery is caus- ing an excessive battery temperature increase.	Replace the battery.		
		4. The battery is undersized.	Replace the battery with a properly sized battery.		
2544 – OVER TEMP	Charger is overheating	1. The charger's ambient temperature is too high.	Move the charger to a cooler location. The charger will automatically start charging again after the internal temperature lowers.		
		 The charger's internal cooling fan is blocked or air inlets are covered. 	Verify that the charger's air inlets on the side of the charger are not blocked and nothing is interfering with fan rotation.		
		3. The charger's internal cooling fan has failed.	Replace the charger.		
9114 – OUTPUT LOST	No Battery Connected	1. Their is no current draw from the charger for 8 sec- onds.	Check battery wire and terminals for continuity.		

TABLE 7. TROUBLESHOOTING (CONT.)

WARNING Some battery charger service procedures present hazards that can result in severe personal injury or death. Only trained and experienced personnel may perform service.

A WARNING Ignition of explosive battery gasses can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.

Fault	Description	Possible Cause	Solution		
9115 – BATT FAIL	Unrecoverable battery	The battery can no longer hold a charge or it has been damaged excessively due to extremely deep discharge.	Replace the battery and cycle through the Setup menus to clear the fault.		
No DC Output	Charger not charging	1. Tripped DC circuit break- er	Correct the possible overload and reset the circuit breaker.		
		2. No battery attached	Make sure the battery is attached before attemting to read DC volts.		
		3. No active AC source	Verify that the AC source is supplying the charger with power.		
		4. Blown AC fuse(s) (277, 380, 416, 480, and 600 VAC battery chargers) Correct the possible overload replace the fuse(s).			
		5. Tripped AC circuit break- er(s) (120, 208, and 240 VAC battery chargers)	Correct the possible overload and reset the circuit breaker.		
		6. Active fault code on char- ger	Clear the fault and verify operation.		
		7. Failed charger	Replace the charger.		
No Display	Display not working	1. The charger is damaged.	Replace the charger.		
		2. AC protection is acti- vated.	Verify that the AC circuit breakers are "On" (up) (120, 208, and 240 VAC chargers) or that the AC input fuses are not blown (277, 380, 416, 480, and 600 VAC chargers).		
		3. AC input is miswired.	Verify that there is AC input voltage at the charger's input terminals.		
		4. There is no active AC source.	Verify that the AC source is supplying the charger with power.		
NOTE: The follow ing down to 379 – OVI	ring faults can only t the charger. EB CUBB	be cleared by cycling completely	through the Setup menu or by power-		
442 – HIG 9115 – BA					

Loss of AC Power

When there is a loss of power, the relay contacts announce this fault as an AC power loss. Since the charger is no longer powered, nothing is displayed on the digital display.

REPLACING FUSES

When replacing a blown fuse on models that use them, be sure to use a fuse of the same rating and type. Do not use fuses of a higher rating. Fuses must be UL and CSA certified. Replacement fuses are listed on page 23.

AWARNING Voltages within the charging system present an electrical shock hazard that can cause severe personal injury or death. Disconnect all sources of AC and DC power from the battery charger before servicing.

- 1. Disconnect the battery charger from AC power and the battery.
- 2. Unscrew the fuse holders from the front of the battery charger.
- 3. Check the fuses and replace the blown fuses(s).
- 4. Reinstall the fuse holders.
- 5. Reconnect the battery charger to AC power and reconnect the charger to the battery.

BATTERY TEMPERATURE SENSOR TEST

To determine that the optional battery temperature sensor functions properly, disconnect the sensor at the battery charger (see page 3) and measure electrical resistance across the two leads of the sensor. Replace the sensor if resistance is not 8000 to 15,000 Ohms at room temperature.

Parts Information



FIGURE 15. BATTERY CHARGER PARTS

REF NO.	PART NO.	QTY USED	PART DESCRIPTION	REF NO.	PART NO.	QTY USED	PART DESCRIPTION
1			Kit, Battery Charger		300-5878	-11 1	480 VAC (ATS production
	300-5878-01	1 1	120, 208, 240 VAC				only)
			(Accessories)		300-5878	-12 1	600 VAC (ATS production
	300-5878-02	2 1	277 VAC (Accessories)				only)
	300-5878-03	31	380 VAC (Accessories)		300-5878	-13 1	120, 208, 240 VAC (Field
	300-5878-04	11	416 VAC (Accessories)				installed ATS accessories)
	300-5878-05	5 1	480 VAC (Accessories)		300-5878	-14 1	277 VAC (Field
	300-5878-06	5 1	600 VAC (Accessories)				installed ATS accessories)
	300-5878-07	71	120, 208, 240 VAC (ATS		300-5878	-15 1	380 VAC (Field
			production only)				installed ATS accessories)
	300-5878-08	31	277 VAC (ATS production		300-5878	-16 1	416 VAC (Field
			only)				installed ATS accessories)
	300-5878-09	91	380 VAC (ATS production		300-5878	-17 1	480 VAC (Field
			only)				installed ATS accessories)
	300-5878-10) 1	416 VAC (ATS production		300-5878	-18 1	600 VAC (Field
			only)				installed ATS accessories)

REF NO.	PART NO.	QTY USED	PART DESCRIPTION	REF NO.	PART NO.	QTY USED	PART DESCRIPTION
	A029Y213	1	120, 208, 240 VAC (THOR	3			Fuse
	A029Y217	1	production) 277 VAC (THOR		0321-040 0321-040	5-01 2 5-02 2	5 Amp – 277 VAC 3.5 Amp – 380 and 416 VAC
			production)		0321-040	5-03 2	2.5 Amp – 480 and 600 VAC
	A029Y218	1	380 VAC (THOR production)	4	541–0918	1	Sensor Kit, Battery Temperature
	A029Y219	1	416 VAC (THOR production)	5	323–1678	-02 1	Connector, Fault Alarm Output
	A029Y220	1	480 VAC (THOR production)				
	A029Y221	1	600 VAC (THOR production)				
	A030K698	1	120, 208, 240 VAC (Low range production)				
2	508-0071	2	Grommet				

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